ARCTIC SECURITY CONSIDERATIONS AND THE U.S. NAVY'S ROADMAP FOR THE ARCTIC

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Arctic sea-ice melting associated with global climate change has caused leaders from the United States and the international community to reconsider the national security implications of the region. Taking into account nearly a century of experience in the Arctic, new national policy, existing strategy, and geopolitical implications of the changing environment, the U.S. Navy has developed an Arctic Roadmap that will guide policy, investment, and action regarding the region. With key themes of improved environmental understanding, informed investments, increased experience, cooperative partnerships, and support for the UN Convention on the Law of the Sea, the Arctic Roadmap is meant to ensure Navy readiness and capability and result in recognition of the Navy as a valued partner by the joint, interagency, and international communities.

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Naval War College Review, Spring 2010, Vol. 63, No. 2

THE CHANGING ARCTIC ENVIRONMENT

The Arctic has long been a dynamic and harsh environment where maritime operations of any kind have been hazardous, if not impossible. Yet traditional views of the Arctic as a nonnavigable region are beginning to shift. Relative to the 1970s, the Earth's temperature has increased sufficiently to cause significant melting of glaciers and diminishment in Arctic sea ice. The prevailing and well established scientific view attributes this temperature change to anthropogenic emissions of "greenhouse" gases.[1]

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
2010		**00-00-2010 to 00-00-2010**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Arctic Security Considerations and the U.S. Navy's Roadmap for the Arctic	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Naval War College,686 Cushing Road,Newport,RI,02841-1207**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **unclassified**	b. ABSTRACT **unclassified**	c. THIS PAGE **unclassified**	**Same as Report (SAR)**	**14**	

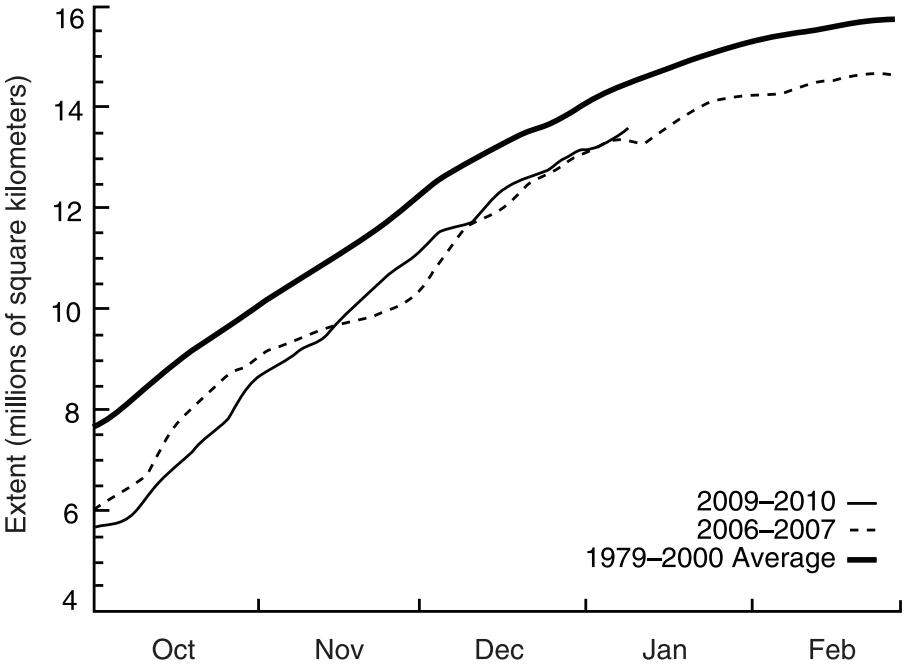
The "greenhouse effect" is the well-known process that keeps the Earth's temperature above the -18°C temperature it would have if greenhouse gases in the atmosphere did not absorb the sun's heat and reradiate it back to the surface. However, the anthropogenic loading of additional greenhouse gases into the atmosphere since the Industrial Revolution has been massive, accelerating the natural climate change processes.[2] Since the 1880s, temperatures have risen 0.8°C—a significant increase in a relatively short period.[3] Greenhouse gases trap more heat in the atmosphere, thereby increasing the average global temperature of the surface and atmosphere.[4] The Arctic is especially vulnerable to global warming, because as snow and ice melt, darker land and ocean surfaces absorb more solar energy. As warming reduces the extent of sea ice, the solar heat absorbed by the oceans in the summer is more easily transferred to the atmosphere in the winter, which makes the air temperature warmer.[5]

As a result, the Arctic is warming twice as fast as the rest of the globe. Specifically, scientists are observing retreating sea ice, melting glaciers, and shrinking snow and permafrost areas.[6] The summer ice cap is estimated to be only half the size it was fifty years ago.[7] Sea-ice extent in the Arctic has decreased steadily since the 1950s and in September 2007 reached a record low that was 39 percent below the 1979–2000 mean. September 2008 experienced the second-lowest Arctic ice extent on record, at 34 percent below the 1970–2000 mean. In September 2009, when the Arctic reached its minimum ice extent for the year, it was recorded at the third-lowest extent since 1979 satellite measurements began, further demonstrating the declining trend in summer sea ice over the past thirty years (see the figure).[8]

Although estimates for when the Arctic will experience ice-free conditions in the summer range from 2013 to 2060, the consensus of most models and researchers is that the Arctic will experience ice-free conditions for a portion of the summer by 2030.[9] It is important to point out that no research or model simulations indicate that winter sea-ice cover of the Arctic Ocean will disappear during this century. This reinforces the point that the Arctic will still be a very challenging environment in which to operate.

Regardless of the exact year that the Arctic becomes ice free in the summer, the widespread warming trend will continue. Multiyear sea ice has also declined rapidly in the central Arctic Ocean; one study based on satellite data for winters during 1978–98 showed that multiyear sea ice declined at a rate of 7 percent per decade.[10] A second study examined twenty-five years of summer ice minima (from 1978 to 2003) and demonstrated a decline of multiyear sea ice as high as 9.2 percent per decade.[11] The multiyear ice is being replaced by first-year sea ice that is considerably weaker and thinner. Because ice cover naturally cools air and

DAILY ARCTIC SEA ICE EXTENT AS OF 9 JANUARY 2010



Source: National Snow and Ice Data Center
Note: Area of ocean with at least 15 percent sea ice.

water masses and plays a significant role in ocean circulation and the reflection of solar radiation back into space, weaker and thinner sea ice has the potential to change the global climate system significantly.[12] The well observed decline in multiyear and summer sea ice is a clear indicator that some of the most rapid climate change on Earth is occurring in the Arctic.[13]

The effects of climate change in the Arctic are observed in the sea, in the air, and on land. Indigenous Arctic people are facing relocation and loss of communities as sea-ice melt causes increased shoreline erosion and melting of permafrost. Impacts on Arctic species include the well publicized decline of the polar bear population and a decline in the algae that attach to the bottom of the ice. The algae form the base of the food chain linking microscopic animals and fish to other animals.[14] In other cases, flora and fauna are experiencing extended growing seasons, and the Arctic is playing host to new species migrating northward with shifting climate patterns; changes in fish migrations coupled with intensified sea-ice melt will yield greater access to fish stocks. These trends clearly demonstrate the need to understand the complex processes occurring in the Arctic.[15]

However, changes in sea ice, sea-level rise, and ocean acidity and their impacts on ecosystems are not well modeled. Most numerical modeling to date has

focused on global change predictions, which have greater confidence than regional change predictions, where weather patterns and ecosystem impacts vary considerably.[16] Present climate projections based on the Intergovernmental Panel on Climate Change Assessment Report (2007) show substantial uncertainty in regional and decadal scales, especially with respect to ice-sheet dynamics and sea-level rise. Data-gathering methods used for climate data are typically designed for other purposes (like agricultural services, weather prediction, or water-resources management) and therefore do not accurately reflect the intricacies needed to detect gradual climate trends.[17] Because the Arctic is such a hostile environment, in situ observations are challenging, if not impossible, in many locations. If it is to understand near- and long-term trends better, the international Arctic science community will need to deploy its resources in the most effective manner.

Natural Resources

One future change in the Arctic region is greater accessibility to, and availability of, natural resources, including offshore oil and gas, minerals, and fisheries. The Arctic contains 10 percent of the world's known petroleum reserves and approximately 25 percent of its undiscovered reserves.[18] The U.S. exclusive economic zone has a potential thirty billion barrels of oil reserves and 221 billion cubic feet in natural gas reserves.[19] Minerals available for extraction in the Arctic include manganese, copper, cobalt, zinc, and gold. Coupled with a rise in global demand for natural oil and gas resources and improved accessibility, the Arctic has become a new focus for oil companies looking for untapped resources. Already $2.6 billion has been spent on active oil and gas leases in the Chukchi Sea.[20] Yet the extraction of these minerals and petroleum reserves depends heavily upon development and deployment of resilient technology that can function in such harsh conditions, marked by lack of infrastructure and long distances to markets.

The warming experienced recently in the Arctic region may improve the availability of certain resources, but it will redistribute others. In the United States alone, redistribution of fish stocks will cause changes for indigenous Alaskans who depend upon the stocks for subsistence. In August 2009 the National Oceanic and Atmospheric Administration (NOAA) released a fishery management plan for the Arctic waters of the United States, including the Chukchi and Beaufort seas, which prohibits commercial fishing in the region until enough information is available to manage the fishery sustainably.[21] Fisheries managers require an understanding of how to maintain sustainable fisheries while taking into account likely intensification in commercial fishing operations. Resource

planners and policy makers will need to examine closely the best ways to manage newly opened areas of the Arctic, balancing multiple and competing uses.

Transportation Access and Operational Challenges

As for natural-resource availability, shipping and transportation will benefit from a more open Arctic. The fabled Northwest Passage and Northern Sea Route will both be navigable for greater periods of time during the summer, and may be utilized more often for commercial shipping. Indeed, the Northern Sea Route offers a 35–60 percent savings in distance—and therefore in time and money — for shipping between Northern Europe and the Far East in comparison to the Suez or Panama canals, making it a very attractive option.[22] Surface-vessel access to "open water" areas within the Arctic will gradually increase from the current few weeks a year to a few months a year, centered around mid-September (the minimum ice extent), although better access will be tempered by the challenges that operation in the Arctic environment poses for the shipping industry.[23] For example, marine insurers are currently offering insurance only on a case-by-case basis, and marine operations are impeded by lack of ice-navigator training programs, most of which are ad hoc in any case.[24] Sea-ice forecasts are limited by a lack of understanding of the exact interrelationships among ice, polar oceans, and the atmosphere, and inability to model variables like sea ice at a fully coupled, regional scale, taking account of complexities that arise from the interactions of global, regional, and local processes.[25] National standards that regulate ship-source pollution vary among Arctic states; shipping companies will also need to invest substantial amounts of money to develop new ice-strengthened vessels and ensure that they operate within environmental compliance guidelines.

Boundary Disputes, Security Concerns

Despite present good relations among Arctic nations, recent media attention paints the area as a source of potential international conflict as countries flex their muscles and seek to identify portions of the region to which they can lay claim. After a team of scientists planted a Russian flag on the seabed of the North Pole, a well publicized article in *Time* magazine in October 2007 posed the question, "Who owns the Arctic?" Over the past few years, in the wake of Russia's actions, the recent years of decreased summer ice extent, and a swell of scientific reports published on climate change, the Arctic has experienced a rise in media attention. Media speculation has spoken of the Arctic as the site of a new Cold War, suggesting that the question of who "owns" the Arctic will cause international conflict. In reality, the "new" Arctic will be one with multiple competing uses by many countries. Indeed, the likelihood of large-scale international

conflict is small, and the Arctic environment will continue to be harsh and challenging for much of the year, making operations difficult and dangerous for the remainder of the twenty-first century.

The legal regime applicable in the Arctic is the customary international law as reflected in the United Nations Convention on the Law of the Sea (UNCLOS). While the United States has not ratified UNCLOS, it considers the convention's navigation and jurisdiction provisions to be binding international law. The convention advances and protects the national security, environmental, and economic interests of all nations, including the United States, codifying the navigational rights and freedoms that are critical to American military and commercial vessels. It also secures economic rights to offshore natural resources.[26] Article 76 of the convention allows nations to claim jurisdiction past their exclusive economic zones on the basis of undersea features that are considered extensions of the continental shelf, if a structure is geologically similar to a nation's continental landmass.[27] In May 2008 five of the Arctic nations adopted the Illulissat Declaration, which acknowledges that "the Law of the Sea is the relevant legal framework in the Arctic" and that there is "no need to develop a new comprehensive international legal regime to govern the Arctic," committing the signatories to an "orderly settlement of any possible overlapping claims."[28]

Currently there are overlapping, unresolved maritime boundary claims between the United States and Canada, Canada and Denmark, Denmark and Norway, and Norway and Russia. At this time, none of these disputed boundary claims pose a threat to global stability. While the United States and Canada disagree on the location of the maritime boundary in and northward of the Beaufort Sea, the United States considers Canada a close ally, and the dispute does not jeopardize this relationship.[29] Unfortunately, the United States is the only Arctic nation that has not joined UNCLOS, despite support from President Barack Obama and the Bush and Clinton administrations. Because the Illulissat Declaration recognizes the law of the sea as the framework for deciding issues of Arctic territoriality, the United States will likely find itself at a disadvantage when critical Arctic conversations occur.[30]

The U.S. Navy is mindful of other international challenges and opportunities in the Arctic. There is some concern in Japan that a renewed Arctic emphasis by the U.S. Navy may lead to a corresponding decrease in western Pacific presence and security. Conversely, there are unique opportunities for the U.S. Navy to develop "soft" partnerships with other nations, such as Russia and China, on research like hydrographic surveys. While present boundary disputes and security concerns pose no major risk to international stability and security, the long-term potential for significant change in the Arctic must be recognized and thoroughly assessed.

THE U.S. NAVY'S ROLE IN A CHANGING ARCTIC

The Navy understands the wide range of security considerations in the Arctic region and that the effects of climate change in the Arctic will influence the geostrategic landscape. Future maritime activity in the region will encompass many non-Arctic stakeholders; the potential exists for the overlap of new operations with indigenous uses and for the occurrence of multiple uses in Arctic waters.[31] The Navy must carefully assess the effects of more severe weather and the rise of sea level on existing installations, while concurrently determining future installation needs. Security, stability, and safety have been, and continue to be, the objectives of the Navy's Arctic activities, despite a potential shift in the type, scope, and location of future missions in the region.

The U.S. Navy has been operating in the Arctic for nearly a century, beginning with Admiral Richard E. Byrd's historic flight over the North Pole in 1926. The Navy sustained its presence in the Arctic during and immediately after World War II, a presence that peaked in 1958, when the USS *Nautilus* (SSN 571) performed the first submerged transit of the North Pole. Navy submarines have remained active in the region ever since and continue to use the area for research and training. Surface assets routinely operate in subarctic conditions. In the 1990s a program known as Science Ice Expedition (SCICEX) used *Sturgeon*-class (SSN 637) nuclear-powered attack submarines to conduct collaborative scientific cruises carrying civilian specialists to the Arctic basin. Six SCICEX missions took place from 1993 to 2000. The missions allowed scientists to gather data on the biological and physical properties of the northern waters and placed emphasis on understanding the dynamics of sea-ice cover, circulation patterns in the water, and the structure of the Arctic Ocean's bathymetry.[32]

Navy surface, aviation, and special warfare forces have participated in joint and combined exercises, such as NORTHERN EDGE, and will continue to do so. Navy surface vessels are able to operate up to the marginal ice zone but will require ice-strengthening to operate in higher ice conditions; Navy aircraft are capable of operating in the Arctic, but the lack of divert fields limits their duration and range. The Navy's Arctic Submarine Laboratory leads the ICEX series, Arctic research-and-development missions whose activities include temporary Arctic ice camps on the edge of the perennial ice.[33] The most recent camp was established in the spring of 2009 on a piece of Arctic pack ice approximately two hundred nautical miles north of Prudhoe Bay, Alaska; it supported about sixty personnel.[34] Great Britain's Royal Navy shares the use of these camps, and cooperative operations involve both U.S. and British submarines. After military operations are concluded, ice camps have on occasion been turned over to civilian researchers, allowing them to take advantage of facilities that would otherwise be beyond their budgets.

While the Navy has a rich history in the Arctic, several challenges must be met to ensure successful operations in the future. These include the lack of support infrastructure and logistics support, environmental hazards such as drifting sea ice and icing on exposed surfaces, and communications difficulties. Antiquated nautical charts, drifting ice, low visibility, and the paucity of electronic and visual navigation aids hinder safety of navigation. A lack of coastal installations also contributes to the difficulty of search and rescue (SAR) operations. The only American-owned deepwater port near the Arctic basin is Dutch Harbor, in the Aleutian Islands.[35]

The Navy and other federal government agencies are taking steps to address some of these challenges. The U.S. State Department recently hosted a conference of representatives from the Arctic Council nations to begin development of a memorandum of understanding for SAR in the Arctic. Senators Mark Begich and Lisa Murkowski of Alaska have recently supported bills that would study the feasibility of a deepwater port in the Arctic. Also, of course, the U.S. Navy has developed a roadmap to ensure its own readiness and capability in the region.

THE U.S. NAVY'S ARCTIC ROADMAP

Despite uncertainty in scientific projections and operational challenges, the time line for change in the Arctic points to a challenge, not a crisis. The Navy's role in the Arctic is to foster and sustain cooperative relationships with other Arctic nations and, within the joint, interagency, international, and academic communities, to improve its understanding of the Arctic environment, enhance its ability to predict changes to it, and prevent or contain any regional instability, through the creation and maintenance of security at sea.

Drivers

In October 2007 the Navy, Coast Guard, and Marine Corps released "A Cooperative Strategy for 21st Century Seapower"—commonly referred to as the "Maritime Strategy"—which states: "Climate change is gradually opening up the waters of the Arctic, not only to new resource development, but also to new shipping routes that may reshape the global transport system. While these opportunities offer potential for growth, they are potential sources of competition and conflict for access and natural resources." The Maritime Strategy clearly identifies freedom of navigation as a top national priority. Preserving the rights of navigation and overflight in the Arctic region supports the Navy's ability to exercise these rights throughout the world, including transit rights in strategic straits.

The Maritime Strategy applies fully in the Arctic as it does in other regions of the globe; it sufficiently addresses the opening Arctic and the potential

challenges and opportunities that phenomenon represents. The core capabilities of the Maritime Strategy that are most applicable to the Arctic are forward presence, deterrence, maritime security, and humanitarian assistance/disaster relief (HA/DR), through the formation and sustainment of cooperative relationships with international partners. As in every other region, the naval services must be prepared to prevent or limit regional conflict when required.

In January 2009, President George W. Bush signed National Security Presidential Directive-66/Homeland Security Presidential Directive-25 (NSPD-66/HSPD-25), which established Arctic-region policy priorities for the nation. The policy declares that the "United States is an Arctic nation, with varied and compelling interests in that region."[36] The directive takes into account altered policies on homeland security and defense, the effects of climate change and increasing human activity in the Arctic, the work of the Arctic Council, and the increasing awareness that the Arctic region is fragile yet rich in resources.[37] The Arctic Region Policy directs the departments of State, Homeland Security, and Defense to develop greater capabilities and capacity as necessary to protect U.S. borders; increase Arctic maritime domain awareness (MDA); preserve global mobility; project a sovereign American maritime presence; encourage peaceful resolution of disputes; cooperate with other Arctic nations to address likely issues arising from greater shipping activity; establish a risk-based capability to address hazards in the region, including cooperative SAR, basing, and logistical support; and evaluate the feasibility for using the Arctic for strategic sealift. These requirements do not promulgate new Navy missions but imply that the service must be prepared to increase Arctic engagement.

In May 2009 the Chief of Naval Operations (CNO), Admiral Gary Roughead, convened a CNO Executive Board to answer questions about the Arctic centering on the changing environment, past and present Navy activity in the Arctic region, future Navy investments, security requirements, fleet capabilities and limitations, and activities of other Arctic nations. The result was the establishment of the Navy's Task Force Climate Change (TFCC) to address Navy implications of climate change, with a near-term focus on the Arctic.

TFCC is directed by the lead coauthor of this article—the Oceanographer of the Navy, Rear Admiral David Titley—and is composed of representatives from offices within the CNO's staff, the fleet, NOAA, and the U.S. Coast Guard. TFCC also includes representatives from the Joint Chiefs of Staff and various interagency, international, scientific, and academic organizations, acting in advisory capacities; the task force consists of a flag-level steering committee, a Navy Climate Change Coordination Office, and several action-oriented working groups. TFCC was initially tasked to develop a document to guide Navy policy, investment, and public discussion regarding the Arctic.

The Vice Chief of Naval Operations approved the resulting Arctic Roadmap in November 2009. The document is synchronized with a science-based time line, provides a framework for Navy discussion of the Arctic, and lists appropriate objectives and actions, tempered by fiscal realities.[38] The need for a science-based time line is clear: if the Navy acts too early it will waste resources, but acting too late will result in mission failure. Understanding the complex changes occurring in the Arctic region requires sound scientific information, upon which policy, strategy, and operations are based. Greater understanding leads to sound decision making that utilizes assets in the safest and most efficient manner.

The roadmap features a five-year action plan that implements both the national Arctic Region Policy and the Navy's Maritime Strategy and lays out initiatives, such as science and technology and combined exercises, to carry out its goals. The roadmap seeks to answer several questions:

- What is the time line for naval Arctic access?
- What is the national security threat?
- Will the Navy be required to increase engagement in the Arctic?
- In what does the Navy need to invest to meet expected Arctic requirements?

Objectives

The main objectives of the Arctic Roadmap are readiness, capability, and security. Specifically, the U.S. Navy seeks to gain improved understanding regarding the current and predicted environment, gain greater experience through established exercises, and make informed investments that will provide the right capability at the right time. The roadmap recognizes that key to its success is cooperative partnerships with interagency and international stakeholders that will improve the Navy's capability to assess and predict climate changes in the Arctic. To achieve these objectives, the roadmap focuses on five areas: Strategy, Policy, Missions, and Plans; Operations and Training; Investments; Communications and Outreach; and Environmental Assessment and Prediction.

Strategy, Policy, Missions, and Plans. Actions in this focus area include the identification of Navy strategic objectives in the Arctic region and the development of guidance to achieve these objectives so as to preserve a safe, stable, and secure Arctic region. Policy and recommendations to operational staffs will be developed to strengthen existing and foster new cooperative relationships.

Operations and Training. Actions in this focus area were identified by U.S. Fleet Forces Command and the geographic combatant command staffs with the

intent of providing a Navy enterprise–wide approach for action regarding the Arctic. Participation in Arctic exercises, operations, and supporting activities is identified, with the intent of increasing Navy experience in the region.

Investments. This focus area seeks to ensure that Arctic requirements are assessed and included in the development of the Program Objective Memorandum or Navy budget. Investment areas that are addressed include weapons platforms and sensors; C4ISR (command, control, communications, computers, intelligence, surveillance, and reconnaissance); and installations and facilities.

Communications and Outreach. This focus area addresses the facts that the Navy can benefit from exchanging information with the wide array of Arctic stakeholders and that media attention will grow as the Arctic endures further rapid and severe change. Targeting organizations within the media, government, Department of Defense, international, scientific, academic, and indigenous communities, actions in this focus area are intended to ensure that the Navy is recognized as contributing to a safe, secure, and stable Arctic region.

Environmental Assessment and Prediction. Actions in this focus area will foster a comprehensive and improved understanding of the current and predicted Arctic physical environment on the tactical, operational, and strategic scales. Because of limited resources and the potential for significant requirements, reducing uncertainty in predictions of the magnitude, timing, and regional location of Arctic environmental change is essential to efficient and responsible Navy action and investment.

Phasing

The roadmap specifies Navy action over three phases, allowing necessary background studies and assessments to be completed, partnerships formed, and knowledge cultivated. TFCC will be responsible for execution of the roadmap and will provide quarterly progress reports to the Chief of Naval Operations.

Phase 1—Fiscal Year (FY) 2010. The first phase of the Arctic Roadmap will include a Fleet Readiness Assessment and an assessment of strategic objectives and mission requirements in the Arctic region. External studies regarding Arctic security will be reviewed, and an Arctic strategic implementation plan for the Maritime Strategy will be completed. The Navy will continue working with NOAA to develop a next-generation, coupled, air-ocean-ice modeling system to predict accurately Arctic environmental change; the Navy will also perform a joint hydrographic survey in the Bering Strait with NOAA. The Navy participated in an Arctic tabletop exercise in November 2009 with the Office of the Secretary of Defense and plans to participate in a "Limited Objective experiment"

with U.S. Northern Command and National Defense University in February 2010.

Phase 2—FYs 2011 and 2012. Significant actions in Phase 2 include initiation of capabilities-based assessments regarding required Navy Arctic capabilities, completion of environmental assessments, and support for implementation of the national ocean policy and coastal and marine spatial planning framework in the Arctic.[39] Recommendations will also be developed to address Arctic requirements in "sponsor program proposals" for the Navy's Program Objective Memorandum for FY 14 (POM 14). Biennial participation in Arctic exercises such as ICEX-11 will continue, and the Navy will formalize new cooperative relationships that increase experience and competence in SAR, MDA, HA/DR in the Arctic, and defense support of civil authorities in Alaska.

Phase 3—FYs 2013 and 2014. During Phase 3, the Navy will oversee execution of POM 14 budget initiatives while implementing and expanding new cooperative partnerships. The Navy will commence Arctic environmental survey operations using unmanned undersea vehicles. In fiscal year 2014 the Arctic Roadmap will be updated in coordination with the 2014 Quadrennial Defense Review, to ensure that the Navy presence in the Arctic is aligned with the strategic objectives of the Department of Defense.

The scope and magnitude of changes to the Arctic region as a result of a changing climate are great, and they cannot all be identified within the scope of this article. Overall, continued sea-ice melting will cause shifts in species populations and distribution, more navigable transportation passages, and increased shipping activity and resource extraction. It also has the potential to modify significantly global circulation patterns around the world, the consequences of which scientists are just beginning to model and comprehend. Each of these changes will shape safety and security in the Arctic.

The Navy's Task Force Climate Change is addressing security considerations in the Arctic by implementing a science-based roadmap for action. Emphasizing the key themes of improved environmental understanding, informed investments, increased experience, cooperative partnerships, and support for the UN Convention on the Law of the Sea, the Arctic Roadmap will ensure the Navy's readiness and capability to operate successfully and safely in the changing Arctic environment in the twenty-first century.

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38. Adm. J. W. Greenert, USN, Task Force Climate Change Charter (Washington, D.C.: U.S. Navy Dept., Vice Chief of Naval Operations, 30 October 2009).
39. In June 2009, an Ocean Policy Task Force was formed by President Obama to develop a National Ocean Policy and Framework for Marine and Coastal Planning. Recommendations from the task force are expected to be approved by the president in March 2010.